

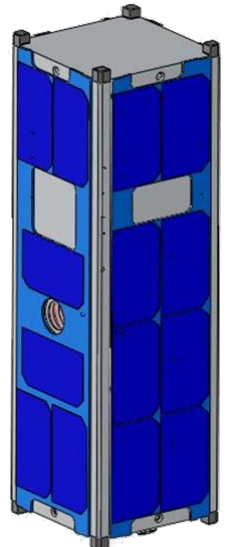
The Colorado Student Space Weather Experiment (CSSWE)

CSSWE COM System

PI: Xinlin Li, Co-PIs: Scott Palo and Shri Kanekal

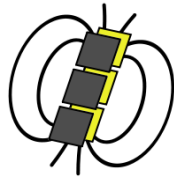
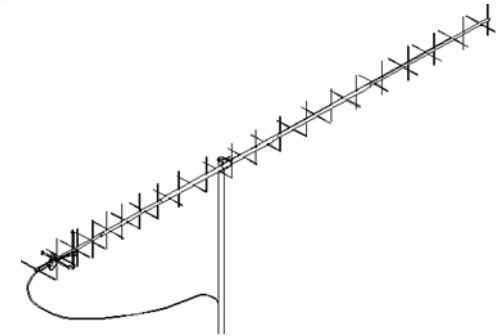
LASP Engineering: Rick Kohnert, Gail Tate,
Vaughn Hoxie

Student Leads: David Gerhardt, Lauren Blum,
Quintin Schiller



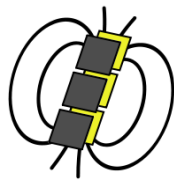
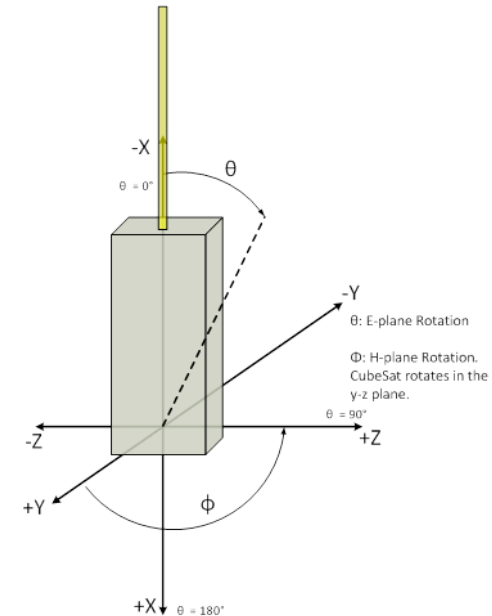
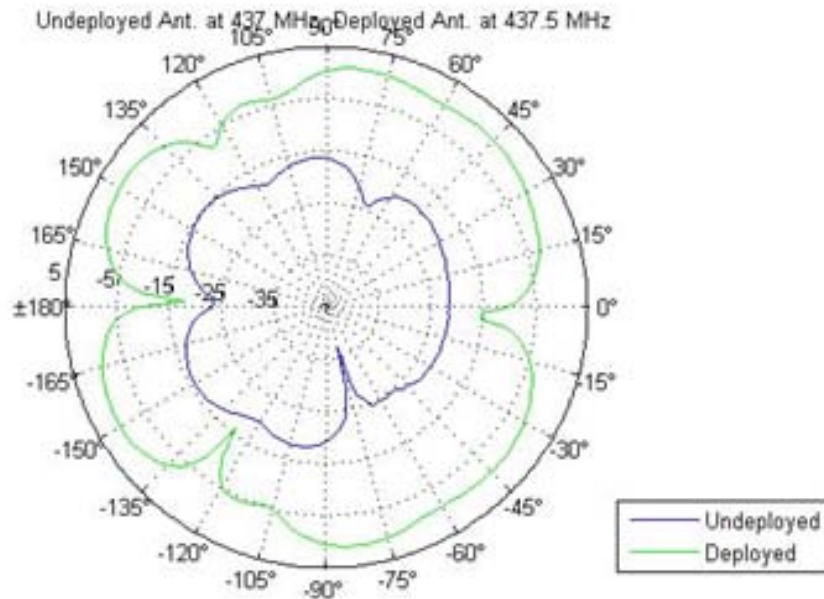
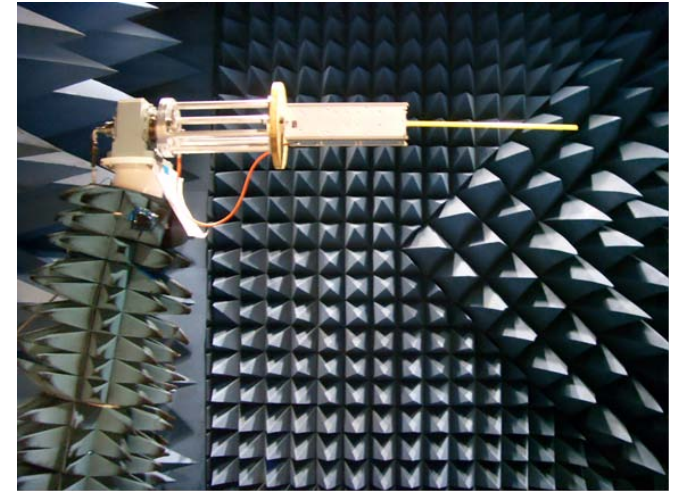
Communications System

- Half Duplex 437.345 MHz
- 9600 bps
- Using AstroDev Lithium radio
- In house designed monopole antenna
- Ground System
 - Kenwood TS-2000
 - Kantronics Kam-XL TNC
 - M2 436CP42



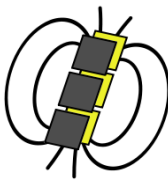
Measured Antenna Performance

- Antenna Testing at FirstRF
- Antenna gain $> -5\text{dBi}$ with exception of 4 nulls
- two along \pm axis as expected, two others at ± 125 degrees
- Antenna closes link budget



Licensing Process

- Scheduled launch on ELANA 6 in August 2012
- Followed process recommended by Jim White
 - Coordinate frequency with IRAU
 - Apply for FRN from FCC
 - Apply for ground-station experimental license to enable testing. Include IRAU letter. License is limited to 365 days.
 - With ground station license granted, 6-9 months before launch apply for experimental license to operate satellite after launch. Use FCC form 422. License is limited to 365 days.
- Received IRAU coordination letter in February 2011 from Hans van de Groenendaal. Process took a few months.
- Submitted application to FCC for temporary experimental license (STA) for ground testing July 7, 2011
- July 14, 2011 FCC requested orbital debris analysis (Part 5.63(e) of FCC rules) – Information was submitted within 7 days
- Error in application (testing date off by 1 year) caused delay. This was identified September 15, 2011 in email exchange with Tony Serafini (FCC).
- Experimental license WF9XDV for ground testing was granted for November 17, 2011 to May 17, 2012
- CONTINUED NEXT SLIDE



Licensing Process - continued

- Application for experimental license for flight was submitted February 13, 2012
 - Experimental Radio Station Authorization (Form 442)
 - <https://apps.fcc.gov/oetcf/els/forms/442Entry.cfm>
- February 21, 2012 FCC requested orbital debris analysis (Part 5.63(e) of FCC rules) – Information was submitted within 7 days. Same information as submitted on previous application.
- April 4, 2012 FCC International Bureau requested additional orbital debris information
 - Item 1.1 No statement of whether there will be operational debris released.
 - Item 1.3 There is no indication as whether orbit is identical or very similar to an orbit used by other satellites. The expected orbital lifetime is not provided.
 - Item 1.4 Portions of the spacecraft will survive re-entry. The applicant should indicate whether any of these will exceed the energy threshold specified in the NASA standard. The applicant also needs to describe insurance and/or indemnification arrangements with respect to casualty risk.
- REPTile instrument has titanium and tungsten that will survive reentry
 - NASA debris assessment software (DAS) indicted that spacecraft is compliant with NASA-STD 8719.14.
 - Currently working with FCC to understand the potential concern

